

### 3.7 SAVANNAH RIVER SITE

The SRS is located approximately 19 km (12 mi) south of Aiken, South Carolina (see Figure 2.2.6–1). First established in 1950, SRS has been involved for more than 40 years in tritium operations and other nuclear material production. Today the site includes 16 major production, service, research, and development areas, not all of which are currently in operation.

There are more than 3,000 facilities at SRS, including 740 buildings with 511,000 m<sup>2</sup> (5,500,000 ft<sup>2</sup>) of floor area. Major nuclear facilities at SRS include fuel and Pu storage facilities and target fabrication facilities, nuclear material production reactors, chemical separations plants, a uranium fuel processing area, liquid HLW tank farms, a waste vitrification facility, and the Savannah River Technology Center. SRS processes nuclear materials into forms suitable for continued safe storage, use, or transportation to other DOE sites. In accordance with the ROD for the *F-Canyon Plutonium Solutions Environmental Impact Statement* (60 FR 9824), and the *Environmental Impact Statement, Interim Management of Nuclear Materials* (60 FR 65300 and 61 FR 6633) Pu solutions have been stabilized and targets have been dissolved and processed in the F-Canyon. A second supplemental ROD announcing DOE's decision for the stabilization of Pu-239 solutions by conversion to metal at F-Canyon and the FB-Line was published September 13, 1996 (61 FR 48474). Tritium recycling facilities at SRS empty tritium from expired reservoirs, purify it to eliminate the helium decay product, and fill replacement reservoirs with specification tritium for nuclear stockpile weapons. Filled reservoirs are delivered to Pantex for weapons assembly and directly to DoD to replace expired reservoirs. Historically, DOE has produced tritium at SRS, but has not produced any since 1988.

**Department of Energy Activities.** The current missions at SRS are shown in Table 3.7–1. [Text deleted.] In the past, the SRS complex produced nuclear materials. The complex consisted of various Pu storage facilities, five reactors (the C-, K-, L-, P-, and R-Reactors) (all inactive), a fuel and target fabrication plant, two chemical separation plants, a tritium-target processing facility, a heavy water rework facility, and waste management facilities. The K-Reactor (the last operational reactor) has been shut down with no planned provision for restart. SRS is still conducting tritium recycling operations in support of stockpile requirements using retired weapons as the tritium supply source. The Separations Facilities, and the F- and H-Canyons, are planned to be used through the year 2002 to complete DOE's commitment to the DNFSB regarding stabilization of site inventories of legacy nuclear materials.

The DOE Office of Environmental Management is pursuing a 30-year plan to achieve full compliance with all applicable laws, regulations, and agreements to treat, store, and dispose of existing wastes; reduce generation of new wastes; clean up inactive waste sites; remediate contaminated groundwater; and dispose of surplus facilities.

The Savannah River Technology Center provides technical support to all DOE operations at SRS. In this role, it provides process engineering development to reduce costs, waste generation, and radiation exposure. SRS has an expanding mission to transfer unique technologies developed at the site to industry. SRS is also an active participant in the Strategic Environmental R&D Program formulated to develop technologies to mitigate environmental hazards at DoD and DOE sites.

**Non-Department of Energy Activities.** Non-DOE facilities and operations at SRS include the Savannah River Forest Station, the Savannah River Ecology Laboratory, and the Institute of Archaeology and Anthropology. The Savannah River Forest Station is an administrative unit of the U.S. Forest Service, which provides timber management, research support, soil and water protection, wildlife management, secondary roads management, and fire management to DOE. The Savannah River Forest Station manages 62,300 ha (154,000 acres), comprising approximately 80 percent of the site area. It has been responsible for reforestation and manages an active timber business. The Savannah River Forest Station assists with the development and updating of sitewide land use and provides continual support with site layout and vegetative management. It also assists in long-term wildlife management and soil rehabilitation projects.

**Table 3.7-1. Current Missions at Savannah River Site**

<b>Mission</b>	<b>Description</b>	<b>Sponsor</b>
Pu storage	Maintain F-Area Pu storage facilities	Assistant Secretary for Environmental Management
Tritium recycling	Operate H-Area tritium facilities	Assistant Secretary for Defense Programs
Stabilize targets, spent nuclear fuels, and other nuclear materials	Operate F- and H-Canyons	Assistant Secretary for Environmental Management
Waste management	Operate waste processing facilities	Assistant Secretary for Environmental Management
Environmental monitoring and restoration	Operate remediation facilities	Assistant Secretary for Environmental Management
Research and development	Savannah River Technology Center technical support of DP, EM, and Nuclear Energy programs	Assistant Secretary for Defense Programs; Assistant Secretary for Environmental Management; Office of Nuclear Energy
Other non-DOE missions	Various, as described in text	Various

Source: SRS 1995a:2.

The Savannah River Ecology Laboratory is operated for DOE by the Institute of Ecology of the University of Georgia. It has established a center of ecological field research where faculty, staff, and students perform interdisciplinary field research and provide an understanding of the impact of energy technologies on the ecosystems of the southeastern United States. This information is communicated to the scientific community, government agencies, and the general public. In addition to Savannah River Ecology Laboratory studies, the Institute of Archaeology and Anthropology is operated by the University of South Carolina to survey the archaeological resources of SRS. These surveys are used by DOE when planning new facility additions or modifications, and are used as reference documents by site management.

### **3.7.1 LAND RESOURCES**

**Land Use.** The SRS occupies approximately 80,130 ha (198,000 acres) in portions of Aiken, Barnwell, and Allendale Counties in southwestern South Carolina, approximately 40 km (25 mi) southeast of Augusta, Georgia (SR DOE 1995e:5-11). All of the land within SRS is owned by the Federal Government and is administered, managed, and controlled by DOE.

*Existing Land Use.* Generalized existing land uses at SRS and in the vicinity are shown in Figure 3.7.1-1. SRS land use can be grouped into three major categories: forest/undeveloped, water, and developed facility locations. Forest/undeveloped lands (for example, open fields and pine or hardwood forests) make up approximately 58,500 ha (144,500 acres) or 73 percent; water (for example, wetlands, streams, and lakes) comprising approximately 17,600 ha (43,500 acres) or 22 percent; and developed facility (for example, production and support areas, roads, and utility corridors) accounts for approximately 4,000 ha (9,900 acres) or 5 percent of the total land area of SRS. A forest management program has been in effect at SRS since 1952, when it was formed through an interagency agreement between DOE, then the AEC, and the U.S. Forest Service (WSRC 1993a:317). The majority of the woodlands area is in revenue producing, managed timber production. Soil map units that meet the soil requirements for prime farmland soils exist on SRS. However, U.S. Department of Agriculture, Natural Resources Conservation Service does not identify these lands as prime farmland due to the nature of site use (that is, the lands are not available for the production of food or fiber) (SR USDA 1995a:1).

In 1972, DOE designated the entire SRS as a NERP. The NERP is used by the national scientific community to study the impact of human activities on the cypress swamp and southeastern pine and hardwood forest ecosystems (DOE 1985a:1).

Land use bordering SRS is primarily forest and agricultural, although there is a substantial amount of open water and nonforested wetland along the Savannah River Valley. Incorporated and industrial areas are the only other significant land uses in the vicinity. There is a small amount of urban and residential development bordering SRS. The closest residences include several located to the west, north, and northeast that are within 61 m (200 ft) of the site boundary.

*Land-Use Planning.* Through Act 489, as amended in 1994, the State of South Carolina requires local jurisdictions (that is, counties and cities) to undertake comprehensive planning. Regional-level planning also occurs within the State, with the State divided into 10 planning districts guided by regional advisory councils. The councils provide technical planning assistance to local jurisdictions at their request. SRS is located within the counties of Aiken, Allendale, and Barnwell, which together constitute part of the Lower Savannah River Council of Governments (SR RCG 1995a:1).

**Visual Resources.** The SRS landscape is characterized by wetlands and upland hills. The vegetation is composed of bottomland hardwood forests, scrub oak and pine woodlands, and wetland forests. DOE facilities are scattered throughout SRS and are brightly lit at night. The developed areas and utility corridors (transmission lines and aboveground pipelines) of SRS are consistent with a BLM VRM Class 5 designation. The remainder of SRS generally ranges from VRM Class 3 to Class 4 designation.

The viewshed consists mainly of agricultural and heavily forested land, with some limited residential and industrial areas. Views are limited by rolling terrain, normally hazy atmospheric conditions, and heavy vegetation. DOE facilities are generally not visible from offsite. The only areas with visual sensitivity levels that are presently impacted by DOE facilities are the view corridors of State Highway 125 and SRS Road 1. The few other areas that have views of SRS facilities are quite distant (8 km [5 mi] or more) and have low visual sensitivity levels.

### 3.7.2 SITE INFRASTRUCTURE

**Baseline Characteristics.** The SRS contains extensive production, service, and research facilities. Not all of these facilities are in operation or needed today. To support current missions and functions, an extensive infrastructure exists, as shown in Table 3.7.2-1. Pu is currently stored in two vaults within the FB-line and three vaults in the 235-F Facility. Under No Action, APSF will be constructed to provide consolidated storage of all SRS nuclear materials. The road infrastructure is used for extensive intrasite transportation requirements. The railroad infrastructure is used to support large volume deliveries of coal and oversized structural components. SRS does not have a connection to the local natural gas lines.

**Table 3.7.2-1. Savannah River Site Baseline Characteristics**

Characteristics	Current Usage	Site Availability
<b>Transportation</b>		
Roads (km)	230	230
Railroads (km)	103	103
<b>Electrical</b>		
Energy consumption (MWh/yr)	659,000	1,672,000
Peak load (MWe)	130	330
<b>Fuel</b>		
Natural gas (m <sup>3</sup> /yr)	0	0
Oil (l/yr)	28,400,000	28,400,000
Coal (t/yr)	210,000	244,000
<b>Steam (kg/hr)</b>	748,440,000	748,440,000

Source: SRS 1993a:3.

The electrical power infrastructure is of critical importance to the proposed actions involving construction of new facilities. The sub-regional electrical power pool area in which SRS is located and from which it draws its power is the Virginia-Carolina Sub-Region, a part of the Southeastern Electric Reliability Council. SRS draws its electrical power predominately from coal-fired plants and from 17 nuclear-powered generating plants. Characteristics of this power pool are given in Table 3.7.2-2.

**Table 3.7.2-2. Virginia-Carolinas Sub-Regional Power Pool Electrical Summary**

Characteristics	Energy Production
<b>Type Fuel<sup>a</sup></b>	
Coal	50%
Nuclear	36%
Hydro/geothermal	2%
Oil/gas	3%
Other <sup>b</sup>	8%
<b>Total Annual Production</b>	272,155,000 MWh
<b>Total Annual Load</b>	284,556,000 MWh
<b>Energy Imported Annually<sup>c</sup></b>	13,846,000 MWh
<b>Generating Capacity</b>	61,932 MWe
<b>Peak Demand</b>	55,477 MWe
<b>Capacity Margin<sup>d</sup></b>	10,443 MWe

<sup>a</sup> Percentages do not total 100 percent due to rounding.

<sup>b</sup> Includes power from nonutility sources only.

<sup>c</sup> Energy imported is not the difference of production and load due to negative net pumped storage.

<sup>d</sup> Capacity margin is the amount of generating capacity available to provide for scheduled maintenance, emergency outages, system operating requirements, and unforeseen electrical demand.

Source: NERC 1993a.

### 3.7.3 AIR QUALITY AND NOISE

**Meteorology and Climatology.** The SRS region has a temperate climate with short, mild winters and long, humid summers. Throughout the year, the climate is frequently affected by warm and moist maritime air masses. The average annual temperature at SRS is 17.3 °C (63.2 °F); temperatures vary from an average daily minimum of 0.0 °C (32 °F) in January to an average daily maximum of 33.2 °C (91.7 °F) in July. The average annual precipitation at SRS is 113.4 cm (44.66 in). Precipitation is distributed fairly evenly throughout the year, with the highest precipitation in summer and the lowest in autumn. There is no predominant wind direction at SRS. The average annual windspeed at Augusta NWS Station is 2.9 m/s (6.5 mph) (NOAA 1994c:3). Additional information related to meteorology and climatology at SRS is presented in Appendix F.

**Ambient Air Quality.** The SRS is located near the center of the Augusta-Aiken Interstate AQCR #53. As of 1995, the areas within SRS and its surrounding counties were in attainment with respect to the NAAQS for criteria pollutants (40 CFR 50; 40 CFR 81.311; 40 CFR 81.341). Applicable NAAQS and the ambient air quality standards for South Carolina and Georgia are presented in Appendix F.

Since the creation of the PSD program in 1977, PSD permits have not been required for any new SRS emission sources, nor have modifications been required to existing permits. There are no known PSD Class I areas within 100 km (62 mi) of SRS.

The emissions inventory for sources at SRS for criteria pollutants are presented in Appendix F. Historically, the primary emission sources of criteria air pollutants at SRS have been the nine coal-burning and four fuel oil-burning boilers that produce steam and electricity (A-, D-, H-, K-, and P-Areas), the fuel and target fabrication facilities (M-Area), and processing facilities (F- and H-Areas). Other emissions and sources include fugitive particulates from coal piles and coal-processing facilities, vehicles, and temporary emissions from various construction-related activities.

Hazardous and toxic air pollutant standards have been adopted by the South Carolina Department of Health and Environmental Control. (No ambient standards for hazardous and toxic air pollutants have been proposed or established by the State of Georgia.) The annual emission rates of hazardous and toxic air pollutants from existing SRS facilities during 1990 are listed in Appendix F.

Table 3.7.3-1 presents the baseline ambient air concentration for criteria pollutants and other pollutants of concern at SRS. As shown in the table, baseline concentrations are in compliance with applicable guidelines and regulations.

**Noise.** Major noise sources at SRS are primarily located in developed or active areas and include various industrial facilities, equipment, and machines (for example, cooling systems, transformers, engines, pumps, boilers, steam vents, paging systems, construction and materials-handling equipment, and vehicles). Major noise emission sources outside of these active areas consist primarily of vehicles and rail operations. Existing SRS-related noise sources of importance to the public are those related to transportation of people and materials to and from the site, including trucks, private vehicles, helicopters, and trains.

Traffic from SRS operations is an important contributor to noise levels along site access highways through the nearby towns of New Ellenton, Jackson, and Aiken. Noise measurements recorded during 1989 and 1990 along State Route 125 in the town of Jackson at a point about 15 m (50 ft) from the roadway indicate that the 1-hour equivalent sound level from traffic ranged from 48 to 72 dBA. The estimated DNL average along this route was 66 dBA for summer and 69 dBA for winter. Similarly, noise measurements along State Route 19 in the town of New Ellenton at a point about 15 m (50 ft) from the roadway indicate that the 1-hour equivalent sound level from traffic ranged from 53 to 71 dBA. The estimated average DNL along this route was 68 dBA for summer and 67 dBA for winter (SR NUS 1990a: Appendices C and D).

**Table 3.7.3-1. Comparison of Baseline Ambient Air Concentrations With Most Stringent Applicable Regulations or Guidelines at Savannah River Site, 1990**

Pollutant	Averaging Time	Most Stringent Regulation or Guideline <sup>a</sup> ( $\mu\text{g}/\text{m}^3$ )	Baseline Concentration ( $\mu\text{g}/\text{m}^3$ )
<b>Criteria Pollutants</b>			
Carbon monoxide	8-hour	10,000 <sup>b</sup>	22
	1-hour	40,000 <sup>b</sup>	171
Lead	Calendar Quarter	1.5 <sup>b</sup>	0.0004
Nitrogen dioxide	Annual	100 <sup>b</sup>	5.7
Ozone	1-hour	235 <sup>b</sup>	<sup>c</sup>
Particulate matter less than or equal to 10 microns in diameter	Annual	50 <sup>b</sup>	3.0
	24-hour	150 <sup>b</sup>	50.6
Sulfur dioxide	Annual	80 <sup>b</sup>	14.5
	24-hour	365 <sup>b</sup>	196
	3-hour	1,300 <sup>b</sup>	823
<b>Mandated by the State of South Carolina</b>			
Total suspended particulates	Annual	75 <sup>d</sup>	12.6
Gaseous fluorides	30-day	0.8 <sup>d</sup>	0.09
	7-day	1.6 <sup>d</sup>	0.39
	24-hour	2.9 <sup>d</sup>	1.04
	12-hour	3.7 <sup>d</sup>	1.99
<b>Hazardous and Other Toxic Compounds</b>			
3,3-Dichlorobenzidine	24-hour	0.15 <sup>d</sup>	0.002
Acrolein	24-hour	1.25 <sup>d</sup>	0.016
Benzene	24-hour	150.00 <sup>d</sup>	31.711
Bis (chloromethyl) ether	24-hour	0.03 <sup>d</sup>	0.002
Cadmium oxide	24-hour	0.25 <sup>d</sup>	0.021
Chlorine	24-hour	75.00 <sup>d</sup>	7.630
Chloroform	24-hour	250.00 <sup>d</sup>	4.957
Cobalt	24-hour	0.25 <sup>d</sup>	0.206
Formic acid	24-hour	225.00 <sup>d</sup>	2.420
Manganese	24-hour	25.00 <sup>d</sup>	0.821
Mercury	24-hour	0.25 <sup>d</sup>	0.014
Nickel	24-hour	0.50 <sup>d</sup>	0.271
Nitric acid	24-hour	125.00 <sup>d</sup>	50.960
Parathion	24-hour	0.50 <sup>d</sup>	0.007
Phosphoric acid	24-hour	25.00 <sup>d</sup>	0.462

<sup>a</sup> The more stringent of the Federal and State standard is presented if both exist for the averaging time.

<sup>b</sup> Federal and State standard.

<sup>c</sup> Data not available from source document.

<sup>d</sup> State standard.

Note: Ozone, as a criteria pollutant, is not directly emitted or monitored by the site. See Section 4.1.3 for a discussion of ozone-related issues.

Source: 40 CFR 50; SC DHEC 1991a; SC DHEC 1992b; SR DOE 1995b.

Most industrial facilities at SRS are at a sufficient distance from the site boundary that noise levels at the boundary from these sources would not be measurable or would be barely distinguishable from background noise levels.

The States of Georgia and South Carolina, and the counties in which SRS is located, have not established any noise regulations that specify acceptable community noise levels, with the exception of a provision in the Aiken County Zoning and Development Standards Ordinance which limits daytime and nighttime noise by frequency band (Appendix F).

### 3.7.4 WATER RESOURCES

**Surface Water.** The most prominent hydrologic feature at SRS is the Savannah River, bordering the site for 32 km (19.9 mi) to the southwest. Six major streams flow through SRS to the Savannah River: Upper Three Runs Creek, Beaver Dam Creek, Fourmile Branch, Pen Branch, Steel Creek, and Lower Three Runs Creek. Upper Three Runs has two tributaries, Tims Branch and Tinker Creek; Pen Branch has one tributary, Indian Grave Branch; and Steel Creek has one tributary, Meyers Branch. These surface water features are shown in Figure 3.7.4-1.

The SRS withdraws surface water from the Savannah River mainly for industrial cooling water purposes. A small quantity is also removed for drinking water supplies. Total water withdrawn from the Savannah River is currently 140,438 million l/yr (37,100 million gal/yr). Most of the water withdrawn is returned to the Savannah River through its onsite tributaries. Streams, especially Fourmile Branch, that received discharges from reactors in the past are still recovering from scouring or erosion impacts. The average flow rate of the Savannah River is 283 m<sup>3</sup>/s (9,990 ft<sup>3</sup>/s). The lowest recorded flow rate, 183 m<sup>3</sup>/s (6,500 ft<sup>3</sup>/s), occurred during a drought period from 1985 to 1988 (SR DOE 1990a:3-18). The minimum flow of Fourmile Branch is 0.16 m<sup>3</sup>/s (5.8 ft<sup>3</sup>/s).

The Savannah River also supplies potable water to several municipalities (SR DOE 1995e:3-8). Upstream from SRS, the Savannah River supplies domestic and industrial water needs to Augusta, Georgia; and North Augusta, South Carolina. The river also receives sewage treatment plant effluent from Augusta, Georgia; North Augusta, Aiken, and Horse Creek Valley, South Carolina; and, as described above, from a variety of SRS operations via onsite stream discharges. Approximately 203 km (126 mi) downstream from SRS, the river supplies domestic and industrial water needs for the Cherokee Hill Water Treatment Plant at Port Wentworth, Georgia, and for Beaufort and Jasper Counties in South Carolina.

There are two manmade water bodies on SRS: L-Lake, which discharges to Steel Creek; and Par Pond, which empties into Lower Three Runs Creek. Naturally-occurring surface water bodies include approximately 190 Carolina bays scattered throughout the site. Carolina bays are closed depressions that may hold water. There are no direct discharges to the bays, but some do receive stormwater runoff.

Average annual treated sanitary discharge volume from SRS to the Savannah River is approximately 700 million l/yr (185 million gal/yr), which is approximately 50 percent of the new centralized sanitary wastewater treatment facility capacity. Wastewater from the treatment plant is discharged to Fourmile Branch.

The proposed facilities are to be located outside of the 100-year floodplain. Sitewide information concerning 500-year floodplains at SRS is not available, but site-specific 500-year floodplain assessments would be completed prior to modifications and/or construction of individual project proposals.

**Surface Water Quality.** In the vicinity of SRS, the Savannah River and onsite streams are classified as fresh water suitable for the following: primary and secondary contact recreation; a source of drinking water, after conventional treatment in accordance with the requirements of the South Carolina Department of Health and Environmental Control; fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora; and industrial and agricultural uses (SC DHEC 1992a:29). Table 3.7.4-1 lists the surface water monitoring results for 1993 for the Savannah River downstream of SRS. The only parameters that exceeded Federal or State water quality criteria were aluminum, manganese, and turbidity.

In addition to water quality monitoring, SRS conducts monitoring to ensure compliance with NPDES permit limits. SRS has two NPDES permits for industrial wastewater discharge that cover 81 outfalls as part of the permit requirements and 1 general stormwater discharge permit that covers 48 outfalls. SRS collects and analyzes water from these outfalls to ensure compliance with NPDES permit limits. Of the 8,000 analyses performed at the industrial outfalls in 1993, 10 exceeded permit limits, for a compliance rate of 99.9 percent. Noncompliances were noted mainly for pH and total suspended solids with one noncompliance each for oil and



Table 3.7.4-1. Summary of Surface Water Quality Monitoring at Savannah River Site, 1993

Parameter	Unit of Measure	Water Quality Criteria and Standards <sup>a</sup>	Water Body Concentration	
			High	Low
Alkalinity	mg/l	NA	24	13
Alpha (gross)	pCi/l	15 <sup>b</sup>	0.51	-0.2
Aluminum	mg/l	0.05 to 0.2 <sup>c</sup>	0.838	0.182
Ammonia (nitrogen)	mg/l	NA	0.11	0.02
Beta (gross)	pCi/l	50 <sup>d</sup>	3.41	0.9
Calcium	mg/l	NA	5.09	3.25
Chemical oxygen demand	mg/l	NA	<dL	<dL
Chromium	mg/l	0.1 <sup>b,e</sup>	<dL	<dL
[Text deleted.]				
Dissolved oxygen	mg/l	>5.0 <sup>e</sup>	10.5	6.2
Iron	mg/l	0.3 <sup>c</sup>	1.15	0.516
Lead	mg/l	0.015 <sup>b</sup>	0.003	<dL
Magnesium	mg/l	NA	1.34	1.11
Manganese	mg/l	0.05 <sup>c</sup>	0.064	0.04
Nitrogen (as NO <sub>2</sub> /NO <sub>3</sub> )	mg/l	NA	0.31	0.18
pH	pH units	6.5 to 8.5 <sup>c</sup>	6.8	6.0
Phosphate	mg/l	NA	<dL	<dL
Plutonium-238	pCi/l	1.6 <sup>f</sup>	0.001	-0.001
Plutonium-239	pCi/l	1.2 <sup>f</sup>	0.001	0.0009
Sodium	mg/l	NA	12.7	5.28
Strontium-90	pCi/l	400 <sup>f</sup>	0.24	0.0017
Sulfate	mg/l	250 <sup>c</sup>	9	4
Suspended solids	mg/l	NA	16	5
Temperature	°C	<32.2 <sup>c</sup>	25.7	9.1
Total dissolved solids	mg/l	500 <sup>c</sup>	90	49
Tritium	pCi/l	80,000 <sup>f</sup>	5,690	-147
Turbidity	turbidity unit	1 to 5 <sup>e</sup>	28	3.6
Zinc	mg/l	5.0 <sup>c</sup>	0.012	<dL

<sup>a</sup> For comparison purposes only.

<sup>b</sup> National Primary Drinking Water Regulations (40 CFR 141).

<sup>c</sup> National Secondary Drinking Water Regulations (40 CFR 143).

<sup>d</sup> Proposed National Primary Drinking Water Regulations; Radionuclides (56 FR 33050).

<sup>e</sup> South Carolina State water quality criteria.

<sup>f</sup> DOE's DCG for water (DOE Order 5400.5). DCG values are based on a committed effective dose equivalent of 100 mrem/yr; however, because the drinking water maximum contaminant level is based on 4 mrem/yr, the number listed is 4 percent of the DCG. All concentrations of radionuclides are determined by subtracting the instrument background environmental level from the monitored location. A negative or zero incremental concentration means that the concentration at the sampling location is equivalent to the background environmental level.

Note: All nonradiological data from station R-10, downstream of SRS; all radiological data from station R-3B (below Vogtle); NA=not applicable; dL=detection limit.

Source: WSRC 1994d; WSRC 1994f.

grease and biological oxygen demand (WSRC 1994d:116). In all cases, either corrective actions or an administrative review were taken to prevent future noncompliances.

*Surface Water Rights and Permits.* Surface water rights for the Savannah River are determined by the Doctrine of Riparian Rights. Under this doctrine, users of water must not adversely effect the quantity or quality of water available for downstream users.

**Groundwater.** Several aquifer system naming schemes have been used at SRS. For this document, the most shallow aquifer will be referred to as the water table aquifer. This aquifer is supported by the leaky "Green Clay" aquitard, which confines the Congaree Aquifer. Below the Congaree Aquifer is the leaky Ellenton aquitard, which contains the Cretaceous (also known as the Tuscaloosa) aquifer. In general at SRS, groundwater in the water table aquifer flows downward to the Congaree Aquifer or discharges to nearby streams that intersect the water table. Flow in the Congaree Aquifer is downward to the Cretaceous Aquifer or horizontal to Upper Three Runs Creek or the Savannah River, depending on the location at SRS. Groundwater in the Cretaceous Aquifer discharges predominantly along the Savannah River. However, Upper Three Runs Creek also receives groundwater from the Cretaceous Aquifer. This flow creates an upward gradient between the Cretaceous and Congaree Aquifer over a significant portion of SRS (Figure 3.7.4-1).

The Cretaceous Aquifer is an abundant and important water resource for the SRS region. Some of the local cities (Aiken, for example) also obtain groundwater from the Cretaceous, but most of the rural population in the SRS region draws water from either the Congaree or water table aquifer. All groundwater at SRS is classified by the EPA as a Class II water source (current and potential source of drinking water). Depth to groundwater ranges from at or very near the ground surface (near streams) to approximately 46 m (151 ft). In 1993, SRS withdrew 13,247 million l/yr (3,500 million gal/yr) of groundwater in support of site operations.

*Groundwater Quality.* Groundwater quality data have been obtained from SRS monitoring wells for the past several years. Groundwater quality at SRS ranges from excellent (soft and slightly acidic) to below EPA drinking water standards for several constituents in the vicinity of some waste sites. The Cretaceous Aquifer is generally unaffected except for a small portion of the A-Area where trichloroethylene has been detected. The Congaree Aquifer is contaminated with trichloroethylene in much of the A- and M-Areas, with trichloroethylene and also some low levels of tritium in the General Separations Area. The water table aquifer is contaminated with solvents, metals, and low levels of radionuclides at several waste sites and facilities at SRS (Figure 3.7.4-1). All contaminated groundwater at SRS discharges to streams on the SRS or the Savannah River. Groundwater quality monitoring data is presented in Table 3.7.4-2.

*Groundwater Availability, Use, and Rights.* Groundwater is a domestic, municipal, and industrial water source throughout the Upper Coastal Plain. Most municipal and industrial water supplies in Aiken County are from the Cretaceous Aquifer. Domestic water supplies are primarily from the Congaree Aquifer and the water table. In Barnwell and Allendale Counties, the Congaree Aquifer supplies some municipal users. Groundwater production from these wells is approximately 13,247 million l/yr (3,500 million gal/yr), which is similar to the volume pumped for industrial and municipal production within 16 km (9.9 mi) of the site.

Groundwater rights in South Carolina are traditionally associated with absolute ownership rule. Originating in English common law doctrine, the owners of land overlying a groundwater resource are allowed to withdraw from their wells all the water they desire (VDL 1990a:725); however, the *Water Use Reporting and Coordination Act* requires all users of 379,000 l/day (100,000 gal/day) or more per day (138.3 million l/yr [36.5 million gal/yr]) of water to report their withdrawal rates to the South Carolina Water Resources Commission. SRS groundwater use exceeds this amount, and, consequently, its withdrawal rates are reported to the commission.

**Table 3.7.4–2. Groundwater Quality Monitoring at Savannah River Site, 1993**

Parameter	Unit of Measure	Water Quality Criteria and Standards <sup>a</sup>	Existing Conditions	
			High	Low
Alpha (gross)	pCi/l	15 <sup>b</sup>	77.61	0.96
Barium	mg/l	2.0 <sup>b</sup>	0.09	0.0017
Beta (gross)	pCi/l	50 <sup>c</sup>	75.88	1.00
Chloride	mg/l	250 <sup>d</sup>	14.69	1.3
Iron	mg/l	0.3 <sup>d</sup>	75.0	0.004
Lead	mg/l	0.015 <sup>b</sup>	0.05	0.0015
Manganese	mg/l	0.05 <sup>d</sup>	0.038	0.0018
Nitrate	mg/l	10 <sup>b</sup>	2.37	0.03
pH	pH units	6.5-8.5 <sup>d</sup>	11.6	4.7
[Text deleted.]				
Sulfate	mg/l	250 <sup>d</sup>	118.1	0.5
Total dissolved solids	mg/l	500 <sup>d</sup>	1,879.4	5.8
Total organic halogens	mg/l	NA	0.84	0.0025
Total phosphates	mg/l	NA	4.7	0.023
Total radium	pCi/l	5.0 <sup>c</sup>	0.52	0.00628
Tritium	pCi/l	80,000 <sup>e</sup>	1,162,810	350

<sup>a</sup> For comparison only.

<sup>b</sup> National Primary Drinking Water Regulations (40 CFR 141).

<sup>c</sup> Proposed National Primary Drinking Water Regulations; Radionuclides (56 FR 33050).

<sup>d</sup> National Secondary Drinking Water Regulations (40 CFR 143).

<sup>e</sup> DOE's DCG for water (DOE Order 5400.5). DCG values are based on a committed effective dose equivalent of 100 mrem per year; however, because the drinking water maximum contaminant level is based on 4 mrem per year, the number listed is 4 percent of the DCG.

Note: NA=not applicable.

Source: SRS 1995a:6.

### 3.7.5 GEOLOGY AND SOILS

**Geology.** The SRS is located in the Aiken Plateau portion of the Upper Atlantic Coastal Plain approximately 32 km (20 mi) east of the Fall Line, a major physiographic and structural feature that separates the Piedmont and Coastal Plain physiographic provinces, in southeastern South Carolina. The plateau is highly dissected, with narrow, steep-sided valleys separated by broad, flat areas.

Coastal Plain sediments underlying SRS consist of sandy clays and clayey sands, although occasional beds of clean sand, gravel, clay, or carbonate occur. The Coastal Plain sediments overlie a basement complex composed of Paleozoic crystalline and Triassic sedimentary formations of the Dunbarton Basin.

Small and discontinuous thin calcareous sand zones, potentially subject to dissolution by water, have been located in some parts of SRS. If dissolution occurs in these zones, potential underground subsidence resulting in settling of the ground surface could occur. No settling as a result of dissolution of these zones has been identified. No economically viable geologic resources have been identified at SRS.

In the immediate region of SRS, there are no known capable faults as defined by 10 CFR 100, Appendix A. Several faults have been identified from subsurface mapping and seismic surveys within the Paleozoic and Triassic basement beneath SRS. The largest of these is the Pen Branch fault. However, there is no evidence of movement within the last 38 million years along this fault (DOE 1991c:4-108).

The SRS is located within Seismic Zone 2, indicating moderate damage could occur as a result of earthquakes (Figure 3.2.5-1). Since 1985, three earthquakes, all of Richter magnitude 3.2 or less, have occurred in the immediate area of SRS (Table 3.2.5-1). None of these earthquakes produced any damage at SRS. Historically, two large earthquakes have occurred within 300 km (186 mi) of SRS. The largest of these, the Charleston earthquake of 1886, had an estimated Richter magnitude ranging from 6.5 to 7.5. Earthquakes capable of producing structural damage to buildings are not likely to occur in the vicinity of SRS (SR DOE 1995e:3-4). There is no volcanic hazard at SRS; the area has not experienced volcanic activity within the last 230 million years.

**Soils.** The soils at SRS are primarily sands and sandy loams. The somewhat excessively drained soils have a thick, sandy surface layer that extends to a depth of 2 m (6.6 ft) or more in some areas (SR USDA 1990a:17-25). Many of the soils are subject to erosion, flooding, ponding, and cutbank caving. The soils at SRS are considered acceptable for standard construction techniques.

### 3.7.6 BIOLOGICAL RESOURCES

**Terrestrial Resources.** Most of SRS has remained undeveloped since it was established in 1950. Only about 5 percent of the site is occupied by DOE facilities. Five major plant communities have been identified at SRS (Figure 3.7.6–1). Of these, the largest is the loblolly, longleaf, slash pine community, which covers approximately 65 percent of the site. This community type, as well as upland hardwood-scrub oak, occurs primarily in upland areas. Swamp forests and bottomland hardwood forests are found along the Savannah River and the numerous streams that traverse SRS. More than 1,300 species and variations of vascular plants have been identified on the site (DOE 1992e:4-126,4-128).

Because of the variety of plant communities on the site, as well as the region's mild climate, SRS supports a diversity and abundance of wildlife, including 43 amphibian, 58 reptile, 213 bird, and 54 mammal species. Common species at SRS include the slimy salamander, eastern box turtle, Carolina chickadee, common crow, eastern cottontail, and gray fox (DOE 1992e:4-128; WSRC 1993b:3-5,3-39). A number of game animals are found on SRS, but only the whitetail deer and feral hog are hunted onsite (DOE 1992e:4-128). Raptors, such as the Cooper's hawk and black vulture, and carnivores, such as the gray fox and raccoon, are ecologically important groups on SRS. A variety of migratory birds have been found at SRS. Migratory birds, as well as their nests and eggs, are protected by the *Migratory Bird Treaty Act*. Eagles are similarly protected by the *Bald and Golden Eagle Protection Act*.

Four of the five major plant communities at SRS are found on the proposed collocated storage site (Figure 3.7.6–1). The most common of these plant communities is the loblolly-longleaf-slash pine, followed by upland hardwood-scrub oak, pine/hardwood, and bottomland hardwood. Although not shown on Figure 3.7.6–1, cleared fields are also common on the proposed site. A 5.5 ha (13.6 acres) NERP oak-hickory forest set-aside area, which has an unusual composition of flora, is located near the northwest corner of the proposed site (SR DOE 1991b:4.3,4.26). Although specific studies of plant and animal communities found on the proposed collocated storage site have not been conducted, the occurrence of species on the site is expected to be the same as found in similar habitats elsewhere on SRS.

Ecological studies of the assumed analysis site for the MOX fuel fabrication facility have not been conducted, but the site is located within an area that primarily contains the loblolly, longleaf, and slash pine forest type (Figure 3.7.6–1). Some bottomland hardwood forest is located along the drainages that feed Par Pond. Wildlife species found in the area of the assumed site would be expected to be similar to those found in similar habitat throughout SRS.

The assumed analysis site for the evolutionary LWR is located in an area that is classified as loblolly, longleaf, and slash pine forest (Figure 3.7.6–1). Previous studies of the site area determined that pine plantations were the predominant plant cover. Other vegetation types present include old-field, bottomland hardwood forest, mixed forest, upland deciduous forest, grassland (under powerline rights-of-way), and emergent wetland. The assumed site has not been surveyed to determine the presence and abundance of wildlife (DOE 1992e:4-128). Animals present would be expected to be similar to those found in similar habitat throughout SRS.

**Wetlands.** The SRS contains approximately 19,800 ha (49,000 acres) of wetlands, most of which are associated with floodplains, streams, and impoundments (DOE 1992e:4-128). Wetlands on the site may be divided into the following categories: bottomland hardwoods, cypress-tupelo, scrub-shrub, emergent, and open water (WSRC 1993b:4-6). The most extensive wetland type on SRS is swamp forest associated with the Savannah River floodplain. Approximately 3,800 ha (9,390 acres) of these wetlands are found on SRS. Past releases of cooling water effluent into site streams and the Savannah River Swamp have resulted in shifts in plant community composition. Changes have included the replacement of bald cypress by scrub-shrub and emergent vegetation in the swamp and reduction in bottomland forests along streams (DOE 1992e:4-128; WSRC 1989e:3-4).

Carolina bays, a type of wetland unique to the southeastern United States, are also found on SRS. Approximately 190 Carolina bays have been identified on the site. These natural shallow depressions occur on interstream areas of SRS and range from lakes to shallow marshes, herbaceous bogs, shrub bogs, or swamp forests (SR NERP 1989a:9).

Wetlands found on the proposed collocated storage site include bottomland hardwoods and three Carolina bays. Bottomland hardwood areas occur along tributaries to Upper Three Runs Creek. The three Carolina bays on the proposed site are typical of the smaller bays found on the SRS (SR DOE 1991b:4.3). All show evidence of previous draining and agricultural use. The larger of the bays is about 1 ha (2.5 acres) in size and is surrounded by oaks and sweet gum. Jurisdictional wetlands subject to COE regulation have not been delineated on this site using the U.S. Army COE *Wetlands Delineation Manual* (Y-87-1).

Wetlands found within the assumed analysis site for the MOX fuel fabrication facility include bottomland hardwoods associated with drainages that feed Par Pond. There are no Carolina bays located on the site. Par Pond, located to the east of the assumed site, supports a well-developed wetland community along its shores. The suitability of habitat in Par Pond for wetland vegetation is indicated by the extensive development of wetland vegetation on the lake and the spread of wetland vegetation from its shore into the lake (DOE 1992e:4-130).

The assumed analysis site for the evolutionary LWR contains a number of wetland areas. Several wetlands are associated with intermittent tributaries to Pen Branch and Fourmile Branch. Isolated wetlands are also found in the site area. Rainbow Bay, a 2.4-ha (5.9-acre) Carolina bay, occurs in the northeastern portion of the assumed site. Other isolated wetlands in the site area are upland depressions. Unlike Rainbow Bay, these wetlands do not have standing water for long periods of time (DOE 1992e:4-129).

**Aquatic Resources.** Aquatic habitat on SRS includes manmade ponds, Carolina bays, reservoirs, and the Savannah River and its tributaries. There are more than 50 manmade impoundments located throughout the site that support populations of bass and sunfish (SR DOE 1982a:4-22; SRS 1992a:8). Fewer than 20 Carolina bays have permanent fish populations. Species present in these bays include redbfin pickerel, mud sunfish, lake chubsucker, and mosquitofish (SR NERP 1983a:40-42; SR NERP 1989a:37). Par Pond and L-Lake support similar fish populations including largemouth bass, black crappie, and various species of pan fish (DOE 1992e:4-131; SRS 1992a:8). Sport and commercial fishing is not allowed on the SRS site (DOE 1992e:4-132).

The Savannah River is used for both commercial and sport fishing. Important commercial species are American shad, hickory shad, and striped bass, all of which are anadromous. The most important warm-water game fish found in the Savannah River are bass, pickerel, crappie, bream, and catfish (SR DOE 1982a:4-28). In the past, water intake structures for C- and K-Reactors and the D-Area powerhouse caused annual estimated entrainment of approximately 10 percent of the fish eggs and larvae passing the intake canals during the spawning season. In addition, estimated impingement losses were approximately 7,600 fish per year (SR DOE 1987b:3-31,C-61).

Aquatic habitat in the vicinity of the proposed storage facility site consists of Upper Three Runs Creek and its tributaries and three Carolina bays (see Figure 3.7.4-1). Streams in the vicinity of the proposed site support largemouth bass, black crappie, and various species of pan fish. Upper Three Runs Creek has never received thermal effluents, but has received industrial pollutants from Tim's Branch. The creek has a rich fauna and is minimally affected by pollutants (SR NERP 1983a:11,13). Upper Three Runs Creek may also be an important spawning area for the blueback herring, and may be seasonally important as a nursery habitat for a number of important Savannah River species, including American shad, blueback herring, and striped bass (SR DOE 1982a:4-28). Information concerning aquatic resources in the three Carolina bays on the proposed site is unavailable (SR DOE 1991b:4.3).

Aquatic resources in the vicinity of the assumed analysis site for the MOX fuel fabrication facility area include Par Pond, precooling ponds 2 and 5, as well as the canal that connects these three water bodies. Also present are a number of drainages that feed Par Pond. Par Pond drains into Lower Three Runs Creek. A total of 30 species of fish, including chubsucker, largemouth bass, bluegill, and black crappie, have been recorded in Par Pond (DOE 1992e:4-131). The same species have been recorded in Lower Three Runs Creek (WSRC 1993b:15-64). During operation of P-Reactor, heated effluent was discharged into an arm of Par Pond (Pond C) via the above-mentioned canal and precooling ponds. Since the shutdown of the P-Reactor, the precooling ponds and Pond C have undergone substantial recovery (DOE 1992e:4-131).

The principal aquatic resources in the vicinity of the assumed analysis site for the evolutionary LWR include Fourmile Branch, Par Branch, and Rainbow Bay. Rainbow Bay does not contain standing water year-round. In the past, Fourmile Branch and Pen Branch have received thermal effluents from C- and K-Reactors, respectively. During reactor operations, fish populations in warmed portions of the streams were greatly reduced, with the mosquitofish being the most abundant species. With the cessation of reactor operation, a more diverse fish population has recolonized both streams (WSRC 1993b:12-44,13-42). Above the reactor outfalls, both Fourmile Branch and Pen Branch are small streams that have been relatively unaffected by past SRS operation. The dominant fish in the un-heated upper reaches of Pen Branch include sunfish, bullheads, and chubsuckers (SR DOE 1987b:3-51); species composition of the upper portion of Fourmile Branch would be expected to be similar.

**Threatened and Endangered Species.** Sixty-one federally and State-listed threatened, endangered, and other special status species may be found on and in the vicinity of SRS (Table 3.7.6-1). Fifty-seven of these species have records of occurrence on SRS, twelve of which are federally or State-listed as threatened or endangered. Once specific project locations have been determined, site surveys will verify the presence of special status species. No critical habitat for threatened or endangered species, as defined in ESA (50 CFR 17.11; 50 CFR 17.12), exists on SRS.

The smooth coneflower is the only endangered plant species found on SRS. Two colonies exist on SRS, but suitable habitat for this species occurs throughout the site. Bald eagles nest near Par Pond and L-Lake and forage on these reservoirs. Wood storks forage in the Savannah River Swamp and the lower reaches of Steel Creek, Pen Branch, Beaver Dam Creek, and Fourmile Branch. Red-cockaded woodpeckers inhabit open pine forests with mature trees (older than 70 years for nesting and 30 years for foraging). Peregrine falcons have been reported in the past as rare winter visitors on SRS. The American alligator is a common inhabitant of Par Pond, Beaver Dam Creek, and the Savannah River Swamp. The shortnose sturgeon spawns in the Savannah River both up and downstream of SRS. This fish has not been collected in the tributaries of the Savannah River that drain SRS, but sturgeon ichthyoplankton have been collected in the river near SRS (SR DOE 1995b:3-44). The Kirtland's warbler is a migrant species which historically occurred on SRS. The State-listed Rafinesque's big-eared bat, common ground dove, and Appalachian Bewick's wren have also been observed on SRS.

There are no federally listed threatened and endangered species known to occur on the proposed storage facility site, but several may exist in the general vicinity. Active bald eagle nests are located about 13.7 km (8.5 mi) southwest of the proposed site in an area of Pen Branch and approximately 12.1 km (7.5 mi) southeast of the site just south of Par Pond. Wood storks have been observed near the Fourmile Branch delta (WSRC 1993b:21-42,21-43) about 21 km (13 mi) from the proposed site. Although suitable forage habitat for the red-cockaded woodpecker exists on the proposed storage facility site, the closest colony is located approximately 4.8 km (3 mi) away. Occurrences of the American alligator are all located about 6.4 km (4 mi) or more from the site (WSRC 1993b:21-11,21-32,21-41,21-42,21-43). The shortnose sturgeon spawns in the Savannah River upstream of SRS, and larvae of this species have been collected in or near the water intake canals on the river. However, entrainment or impingement of this species at SRS water intake structures has not been documented (DOE 1992e:4-132). The smooth coneflower has not been recorded in affected areas but could be found on the proposed site. Several State special status species have also been found in the proposed storage site area.

**Table 3.7.6–1. Federally and State-Listed Threatened, Endangered, and Other Special Status Species That May Be Found on or in the Vicinity of Savannah River Site**

Common Name	Scientific Name	Status <sup>a</sup>	
		Federal	State
Mammals			
Meadow vole	<i>Microtus pennsylvanicus</i>	NL	SC
Rafinesque's big-eared bat <sup>b</sup>	<i>Plecotus rafinesquii</i>	NL	SE
Southern Appalachian eastern woodrat <sup>b</sup>	<i>Neotoma floridana haematoreia</i>	NL	SC
Spotted skunk <sup>b</sup>	<i>Spilogale putorius</i>	NL	SC
Star-nosed mole <sup>b</sup>	<i>Condylura cristata parva</i>	NL	SC
Swamp rabbit	<i>Sylvilagus aquaticus</i>	NL	SC
Birds			
American peregrine falcon <sup>b,c</sup>	<i>Falco peregrinus anatum</i>	E	SE
American swallow-tailed kite	<i>Elanoides forficatus</i>	NL	SE
Appalachian Bewick's wren <sup>b</sup>	<i>Thryomanes bewickii altus</i>	NL	ST
Arctic peregrine falcon <sup>b</sup>	<i>Falco peregrinus tundrius</i>	E (S/A)	ST
Bald eagle <sup>b,c</sup>	<i>Haliaeetus leucocephalus</i>	T	SE
Barn owl <sup>b</sup>	<i>Tyto alba</i>	NL	SC
Common ground dove <sup>b</sup>	<i>Columbina passerina</i>	NL	ST
Cooper's hawk <sup>b</sup>	<i>Accipiter cooperii</i>	NL	SC
Kirtland's warbler <sup>b</sup>	<i>Dendroica kirtlandii</i>	E	SE
[Text deleted.]			
Mississippi kite <sup>b</sup>	<i>Ictinia mississippiensis</i>	NL	SC
Red-cockaded woodpecker <sup>b,c</sup>	<i>Picoides borealis</i>	E	SE
Red-headed woodpecker <sup>b</sup>	<i>Melanerpes erythrocephalus</i>	NL	SC
Swainson's warbler <sup>b</sup>	<i>Limnothlypis swainsonii</i>	NL	SC
Wood stork <sup>b,d</sup>	<i>Mycteria americana</i>	E	SE
Reptiles			
American alligator <sup>b</sup>	<i>Alligator mississippiensis</i>	T (S/A)	NL
Carolina swamp snake <sup>b</sup>	<i>Seminatrix pygaea</i>	NL	SC
Eastern coral snake <sup>b</sup>	<i>Micrurus fulvius fulvius</i>	NL	SC
Green water snake <sup>b</sup>	<i>Nerodia cyclopion</i>	NL	SC
[Text deleted.]			
Spotted turtle <sup>b</sup>	<i>Clemmys guttata</i>	NL	SC
Amphibians			
Carolina crawfish frog <sup>b</sup>	<i>Rana areolata capito</i>	NL	SC
Eastern bird-voiced treefrog <sup>b</sup>	<i>Hyla avivoca ogechiensis</i>	NL	SC
Eastern tiger salamander <sup>b,d</sup>	<i>Ambystoma tigrinum tigrinum</i>	NL	SC
Northern cricket frog <sup>b</sup>	<i>Acris crepitans crepitans</i>	NL	SC
Pickerel frog <sup>b,d</sup>	<i>Rana palustris</i>	NL	SC
Upland chorus frog <sup>b</sup>	<i>Pseudacris triseriata feriarum</i>	NL	SC



**Table 3.7.6–1. Federally and State-Listed Threatened, Endangered, and Other Special Status Species That May Be Found on or in the Vicinity of Savannah River Site—Continued**

Common Name	Scientific Name	Status <sup>a</sup>	
		Federal	State
Fish			
[Text deleted.]			
Shortnose sturgeon <sup>b,c,d</sup>	<i>Acipenser brevirostrum</i>	E	SE
Invertebrates			
Brother spike mussel	<i>Elliptio fraterna</i>	NL	E
Plants			
[Text deleted.]			
Beak-rush <sup>b,d</sup>	<i>Rhynchospora inundata</i>	NL	SC
Beak-rush <sup>b,d</sup>	<i>Rhynchospora tracyi</i>	NL	SC
Bog spice bush <sup>b</sup>	<i>Lindera subcoriacea</i>	NL	RC
[Text deleted.]			
Cypress stump sedge <sup>b,d</sup>	<i>Carex decomposita</i>	NL	SC
Durand's white oak <sup>b</sup>	<i>Quercus durandii</i>	NL	SC
Dwarf bladderwort <sup>b</sup>	<i>Utricularia olivacea</i>	NL	SC
Dwarf burhead <sup>b</sup>	<i>Echinodorus parvulus</i>	NL	SC
Elliott's croton <sup>b</sup>	<i>Croton elliotii</i>	NL	SC
Few-fruited sedge <sup>b</sup>	<i>Carex oligocarpa</i>	NL	SC
Florida bladderwort <sup>b</sup>	<i>Utricularia floridana</i>	NL	SC
Florida false loosestrife <sup>b</sup>	<i>Ludwigia spathulata</i>	NL	SC
Gaura <sup>b</sup>	<i>Gaura biennis</i>	NL	SC
Green-fringed orchid <sup>b,d</sup>	<i>Platanthera lacera</i>	NL	SC
Leafy pondweed <sup>b</sup>	<i>Potamogeton foliosus</i>	NL	SC
Loose water-milfoil <sup>b</sup>	<i>Myriophyllum laxum</i>	NL	RC
Milk-pea <sup>b</sup>	<i>Astragalus villosus</i>	NL	SC
Nailwort <sup>b,d</sup>	<i>Paronychia americana</i>	NL	SC
Nestronia <sup>b</sup>	<i>Nestronia umbellula</i>	NL	SC
Nutmeg hickory <sup>b</sup>	<i>Carya myristiciformis</i>	NL	RC
Oconee azalea <sup>b</sup>	<i>Rhododendron flammeum</i>	NL	SC
Pink tickseed <sup>b</sup>	<i>Coreopsis rosea</i>	NL	RC
Quill-leaved swamp potato <sup>b</sup>	<i>Sagittaria isoetiformis</i>	NL	SC
Sandhill lily <sup>b</sup>	<i>Nolina georgiana</i>	NL	SC
Smooth coneflower <sup>b</sup>	<i>Echinacea laevigata</i>	E	SE
Trepocarpus <sup>b</sup>	<i>Trepocarpus aethusae</i>	NL	SC
Wild water-celery <sup>b</sup>	<i>Vallisneria americana</i>	NL	SC
Yellow cress <sup>b</sup>	<i>Rorippa sessiliflora</i>	NL	SC
Yellow wild indigo <sup>b</sup>	<i>Baptisia lanceolata</i>	NL	SC

<sup>a</sup> Status codes: E=endangered; NL=not listed; RC=regional of concern (unofficial plants only); S/A=protected under the similarity of appearance provision of the ESA; SC=State of concern; SE=State endangered (official state list-animals only); ST=State threatened (official State list-animals only); and T=threatened.

<sup>b</sup> Species occurrence recorded on SRS.

<sup>c</sup> USFWS Recovery Plan exists for this species.

<sup>d</sup> Species known to occur on Upper Three Runs Creek downstream from the proposed site for the new consolidated storage facility or in areas affected by the project.

Source: 50 CFR 17.11; 50 CFR 17.12; DOE 1992e; SC WD 1995a; SR NERP 1990b; WSRC 1993b.

A population of nailwort has been found within the central portion of the site and the green-fringed orchid has been collected in an area adjacent to the site (SR NERP 1990b:64-65).

Bald eagles have been seen on numerous occasions in the vicinity of Par Pond, and an eagle nest is located about 5.6 km (3.5 mi) southeast of the assumed analysis site for the MOX fuel fabrication facility. Although suitable forage habitat for the red-cockaded woodpecker exists in the site area, the nearest known red-cockaded colony is located about 8 km (5 mi) to the southeast. The American alligator is also a common inhabitant of Par Pond, located less than 1.6 km (1 mi) from the assumed site (WSRC 1993b:21-11,21-26,21-32).

There are no federally listed threatened and endangered species known to occur on the assumed analysis site for the evolutionary LWR, but several may exist in the general vicinity. Bald eagles have been observed at several locations on SRS, particularly in the vicinity of Par Pond and L-Lake. Active bald eagle nests are located 8 km (5 mi) southwest of the site in the area of Pen Branch and 11.3 km (7 mi) southeast of the site just south of Par Pond (WSRC 1993b:21-26). Although suitable forage habitat for the red-cockaded woodpecker exists on the assumed analysis site for the evolutionary LWR, the closest colony is located 11.3 km (7 mi) away. The American alligator is a common inhabitant of Par Pond, Beaver Dam Creek, and the Savannah River swamp, all located 8 km (5 mi) or more from the assumed site (WSRC 1993b:21-11,21-32,21-41,21-43). The federally listed smooth purple coneflower has not been recorded in the site but could be present. [Text deleted.] Several State special status species have also been found near Rainbow Bay, including the Cooper's hawk, two species of beak-rush, Florida false loosestrife, and green-fringed orchid.

### 3.7.7 CULTURAL AND PALEONTOLOGICAL RESOURCES

**Prehistoric Resources.** Prehistoric resources at SRS consist of villages, base camps, limited activity sites, quarries, and workshops. An extensive archaeological survey program began at SRS in 1974 and includes numerous field studies such as reconnaissance surveys, shovel test transects, and intensive site testing and excavation. More than 60 percent of SRS has received some level of cultural resources evaluation. More than 800 prehistoric sites have been identified, some of which may fall within the locations of the proposed storage facilities. Fewer than 8 percent of these sites have been evaluated for NRHP eligibility. To date 67 prehistoric and historic sites are considered potentially eligible for listing on the NRHP.

A Programmatic Agreement was signed by the DOE Savannah River Operations Office, the South Carolina SHPO, and the Advisory Council on Historic Preservation on August 24, 1990. Its purpose is to ensure that appropriate measures are taken to inventory, evaluate, protect, and enhance archaeological sites on SRS. In addition, an Archaeological Resource Management Plan for SRS is in place.

**Historic Resources.** Types of historic sites include farmsteads, tenant dwellings, mills, plantations and slave quarters, rice farming dikes, dams, cattle pens, ferry locations, towns, churches, schools, cemeteries, commercial building locations, and roads. Approximately 400 historic sites or sites with historic components have been identified within SRS, some of which may fall within the locations of the proposed storage facilities. To date, approximately 10 percent have been evaluated for NRHP eligibility.

Most historic structures were demolished during the initial establishment of SRS in 1950. Two 1951 buildings are currently in use. SRS has been involved in tritium operations and other nuclear material production for more than 40 years. Therefore, some of the facilities at SRS may be eligible for listing on the NRHP.

**Native American Resources.** Native American groups with traditional ties to the area include the Apalachee, Cherokee, Chickasaw, Creek, Shawnee, Westo, and Yuchi. At different times, each of these groups was encouraged by the English to settle in the area to provide protection from the French, Spanish, or other Native American groups. Main villages of both the Cherokee and Creek were located southwest and northwest of SRS, but both groups may have used the area for hunting and gathering activities. During the early 1800s, most of the remaining Native Americans residing in the region were relocated to the Oklahoma territory.

Native American resources in the region include remains of villages or townsites, ceremonial lodges, burials, cemeteries, and areas containing traditional plants used for religious ceremonies. Literature reviews and consultations with Native American representatives reveal that there are some concerns related to the *American Indian Religious Freedom Act* within the central Savannah River valley, including some sensitive Native American resources and several plants traditionally used in ceremonies (SR DOE 1991e:19,21).

**Paleontological Resources.** Paleontological materials at SRS include fossil plants, numerous invertebrate fossils, deposits of giant oysters (*Crassostrea gigantissima*), mollusks, and bryozoa. All paleontological materials from SRS are marine invertebrate deposits and, with the exception of the giant oysters, are relatively widespread common fossils; therefore the assemblages have low research potential.

### 3.7.8 SOCIOECONOMICS

Socioeconomic characteristics addressed at SRS include employment and regional economy, population and housing, community services, and local transportation. Statistics for employment and regional economy are presented for the REA that encompasses 15 counties around SRS located in Georgia and South Carolina (Table L.1-1). Statistics for population and housing, community services, and local transportation are presented for the ROI, a six-county area in which 90.1 percent of all SRS employees reside: Aiken County (51.9 percent), Allendale County (1.1 percent), Bamberg County (1.7 percent), and Barnwell County (7.3 percent) in South Carolina and Columbia County (10.6 percent) and Richmond County (17.5 percent) in Georgia (Table L.1-7). In 1993, SRS employed 23,351 persons which decreased to 16,562 persons in 1996.

**Regional Economy Characteristics.** Selected employment and regional economy statistics for the SRS REA are summarized in Figure 3.7.8-1. Between 1980 and 1990, the civilian labor force in the REA increased 21.4 percent to the 1990 level of 248,239. The 1994 unemployment in the REA was 6.7 percent, which was approximately 0.4 and 1.5 percent higher than the unemployment for South Carolina and Georgia, respectively. The region's per capita income of \$17,212 in 1993 was approximately 2.1 percent greater than South Carolina's per capita income of \$16,861 and 10.6 percent lower than Georgia's per capita income of \$19,249.

In 1993, the percentage of total employment involving the private sector activity of retail trade in the REA (16 percent) was comparable to the statewide economies of South Carolina and Georgia, as shown in Figure 3.7.8-1. Service employment in the region (22 percent of total employment) represented a 3-percent smaller share of the total employment in the region than in Georgia but was similar to that of South Carolina. The manufacturing sector in the region (21 percent) represented a 1- and 6-percent greater share of the total employment than in South Carolina (20 percent) and Georgia (15 percent), respectively.

**Population and Housing.** In 1994, the ROI population totaled 457,812. From 1980 to 1994, the ROI population grew by 21.7 percent, compared to 29.1 percent in Georgia and 17.4 percent in South Carolina. Within the ROI, Columbia County experienced the largest increase, 99.2 percent, while Bamberg County's population decreased 7.8 percent. Population and housing trends are summarized in Figure 3.7.8-2.

The increase in number of housing units in the ROI between 1980 and 1990, 23.8 percent, was similar to the increase in South Carolina, but approximately 6 percent less than the increase in Georgia. The total number of housing units for 1990 was 168,803. The 1990 homeowner vacancy rate for the ROI, 2.2 percent, was comparable to the statewide rates for South Carolina and Georgia. The renter vacancy rate for the ROI counties, nearly 10 percent, was approximately 2 percent less than the renter vacancy rates for both States.

**Community Services.** Education, public safety, and health care characteristics were used to assess the level of community service in the SRS ROI. Figure 3.7.8-3 presents school district characteristics for the SRS ROI. Figure 3.7.8-4 presents public safety and health care characteristics.

**Education.** In 1994, nine school districts provided public education services and facilities in the SRS ROI. As shown in Figure 3.7.8-3, these school districts operated at between 58.7-percent (Allendale County) and 100-percent (Columbia County School District) capacity. The average student-to-teacher ratio for the SRS ROI in 1994 was 17.5:1. The Aiken County School District had the highest ratio at 19:1.

**Public Safety.** City, county, and State law enforcement agencies provided police protection to the residents in the ROI. In 1994, a total of 954 sworn police officers were serving the six-county ROI. Richmond County employed the greatest number of sworn police officers (325), while the city of Augusta, Georgia had the highest officer-to-population ratios (3.9 sworn officers per 1,000 persons). The average ROI officer-to-population ratio was 2.1 officers per 1,000 persons. Figure 3.7.8-4 compares police force strengths across the ROI.

Fire protection services in the SRS ROI were provided by 1,363 paid and volunteer firefighters in 1995. The fire district with the highest firefighter-to-population ratio was located in Bamberg County, 9.3 firefighters per 1,000 persons, as indicated in Figure 3.7.8–4. Aiken County employed the greatest number of firefighters (375). The average firefighter-to-population ratio in the ROI was 3.0 firefighters per 1,000 persons.

**Health Care.** There were eight hospitals serving the six-county ROI in 1994. Figure 3.7.8–4 displays the hospital bed-to-population ratios for the SRS ROI counties. During 1994, all hospitals were operating below capacity, with hospital occupancy rates ranging from 45.7 percent in Barnwell County to 73.8 percent in Bamberg County.

In 1994, a total of 1,360 physicians served the ROI, with the majority (985) located in Richmond County. Figure 3.7.8–4 shows that the physician-to-population ratios for the ROI ranged from 0.4 physicians per 1,000 persons in Barnwell County to 5.0 physicians per 1,000 persons in Richmond County. The average ROI physician-to-population ratio was 3.0 physicians per 1,000 persons.

**Local Transportation.** The SRS is served by more than 322 km (200 mi) of primary roads and more than 1,609 km (1,000 mi) of unpaved secondary roads (see Figure 2.2.6–1 and Figure 2.2.6–2). The primary highways used by SRS commuters are State Routes 19, 64, and 125. There are no current or planned road improvements that would affect SRS.

Two road segments in the ROI could be affected by the storage and disposition alternatives. The first is South Carolina State Route 19 from U.S. 1/78 at Aiken to U.S. 278. This segment operated at level of service E in 1995. The second is South Carolina State Route 230 from U.S. 25 Business at North Augusta to U.S. 1/25/78/278. This segment operated at level of service E in 1995.

There is no public transportation to SRS (SR DOT 1995a:1). Rail service in the ROI is provided by the Norfolk Southern Corporation and CSX Transportation. SRS is provided rail access via Robbins Station on the CSX Transportation line. In addition, SRS maintains 101 km (63 mi) of onsite track for internal uses (DOE 1993j:4-60).

Waterborne transportation is available via the Savannah River. Currently, the Savannah River is used primarily for recreation (DOE 1993j:4-60). SRS has no commercial docking facilities, but it has a boat ramp that has accepted large transport barge shipments (SRS 1995a:9.)

Columbia Metropolitan Airport in the city of Columbia, South Carolina and Bush Field in the city of Augusta, Georgia, receive jet air passenger and cargo service from both national and local carriers. Numerous smaller private airports are located in the ROI.